

SUPPLEMENTAL AGREEMENT  
BETWEEN  
THE UNIVERSITY OF HOUSTON

AND  
THE U. S. NUCLEAR REGULATORY COMMISSION

THIS SUPPLEMENTAL AGREEMENT, effective the 24th day of October , 1978, by and between the UNITED STATES OF AMERICA (hereinafter referred to as the "Government"), as represented by the UNITED STATES NUCLEAR REGULATORY COMMISSION (hereinafter referred to as the "Commission"), and THE UNIVERSITY OF HOUSTON (hereinafter referred to as the "Contractor"),

WITNESSETH THAT:

WHEREAS, the parties desire to modify Contract No. NRC-04-78-213 as hereinafter provided, and this supplemental agreement is authorized by law, including the Energy Reorganization Act of 1974, as amended, and the Atomic Energy Act of 1954, as amended.

NOW, THEREFORE, said contract is hereby modified as follows:

1. Appendix A, attached to this supplemental agreement and made a part hereof, replaces in its entirety the Appendix A attached to the original contract document.
2. In Article III - Consideration, the sum "\$142,979.00" is substituted for the sum "\$66,404.00."

7903050054

IN WITNESS WHEREOF, the parties have executed this document.

UNITED STATES OF AMERICA

BY:

Kellogg V. Morton  
Kellogg V. Morton, Chief  
Research Contracts Branch  
(title)

Nuclear Regulatory Commission

THE UNIVERSITY OF HOUSTON

BY:

Julie T. Norris  
Julie T. Norris, Assistant Vice  
Chancellor & Director, Research Admin.  
(title)

I, James Bishop, certify that I am the  
(attester)

Controller of the Contractor named  
(title)

under this document; that Julie T. Norris  
(signatory)

who signed this document on behalf of said Contractor was then  
Ass't. Vice Chancellor & Dir., Res. Admin. of said Contractor; that  
this document was duly signed for and on behalf of said Contractor by  
authority of its governing body and is within the scope of its legal  
powers.

IN WITNESS WHEREOF, I have hereunto affixed my hand and the seal of  
said Contractor.

James Bishop

(SEAL)

CONTRACTOR: THE UNIVERSITY OF HOUSTON

APPENDIX A

For the Contract period January 1, 1978 through December 31, 1979

Article A-I RESEARCH TO BE PERFORMED BY CONTRACTOR

- (a) The scope of work under this contract is unclassified and shall be in accordance with Contractor's proposal entitled, "Studies of Gas-Liquid Flow Patterns," dated October 1977, which is incorporated herein by reference and includes the following tasks:

Year 1

1. Perform screening tests with rod assemblies to develop information needed for the design of the distributor and of the test section.
2. Design, construct and instrument the test section and modify the existing facility. The test section with its instrumentation should be able to provide experimental data needed for modeling two-phase flow regimes which exist in rod bundle geometries of interest to PWR and BWR.
3. Perform a preliminary analysis of two-phase flow regimes possible in flows parallel to rod bundles.

Year 2

1. Conduct experiments and acquire experimental data to develop mechanistic models for predicting flow regime boundaries in steady state, two-phase flows along rod bundles with and without spacers.
2. Analyze experimental data and conduct analytical modeling studies.
3. Design and order instrumentation required for studies of two-phase flow regimes in transient flows.

- (b) The Principal Investigator expects to devote the following approximate amount(s) of time to the contract work:

Professor A. E. Dukler - 100% of his time for one summer month  
for 2 years

ARTICLE A-II WAYS AND MEANS OF PERFORMANCE

- (a) Items for which support will be provided as indicated in A-III, below

(1) Salaries and Wages \$ 53,125.00

(2) Equipment to be purchased or  
fabricated by the Contractor \$ 40,000.00

Over \$1,000.00

- . Transparent Test Section  
Supplies and Fabrication
- . Laser Doppler Counter
- . Laser
- . PM Tube and Power Supply
- . Storz Lens Endoscope System
- . Liquid Flow Control Loop
- . Air Flow Control Loop

Under \$1,000.00

- . Pump and Driver
- . Flow Meters (3)
- . Pressure Transducers and Bridges
- . Electronic Components  
(Amplifiers, Meters, Potentiometers, etc.)
- . Valves and Fittings
- . Control Valves and Piping Components
- . Electronic Equipment

- (3) Travel
- |              |                    |
|--------------|--------------------|
| (i) Domestic | \$ <u>3,000.00</u> |
| (ii) Foreign | \$ <u>-0-</u>      |
- (4) Other direct costs including fringe benefits
- (5) Indirect costs based on a predetermined rate of 55 percent applicable to salaries and wages

- (b) Items, if any, significant to the performance of this contract, but excluded from computation of Support Cost and from consideration in proportioning costs:

NONE

- (c) Time or effort of Principal Investigator(s) including indirect costs and fringe benefits contributed by Contractor but excluded from computation of Support Cost and from consideration in proportioning costs:

Supervision, as Required

#### Article A-III

The total estimated cost of items under A-II(a) above for the contract period stated in this Appendix A is \$142,979.00 ; the Commission will pay 100 percent of the actual costs of these items incurred during the contract period stated in this Appendix A, subject to the provisions of Article III and Article B-XXVIII. The estimated NRC Support Cost for the contract period stated in this Appendix A is \$142,979.00 .

The estimated NRC Support Cost is funded as follows:

- |   |                      |
|---|----------------------|
| (a) Estimated unexpended balance from prior period(s) | \$ <u>-0-</u>        |
| (b) New funds for the current period                  | \$ <u>142,979.00</u> |
- (c) The new funds being added in A-III(b) constitute the basis for advance payments provided under Article B-X.